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Signed J Evans.

Dated 3 September 2004

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P01/7700 0.00-0327752.2

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Request for grant of a patent

(see the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

The Patent Office
Cardiff Road
Newport
South Wales
NP10 8QQ

1. Your reference — C1368.00/C

29 NOV 2003

2. Patent application number *(The Patent Office will fill in this part)* — 0327752.2

3. Full name, address and postcode of the or of each applicant *(underline all surnames)* — C4 Carbides Plc
9 Nuffield Road
Cambridge
CB4 1TF

Patents ADP number *(if you know it)* — 7695620001

If the applicant is a corporate body, give the country/state of its incorporation — England and Wales

4. Title of the invention — Saw Blades

5. Name of your agent *(if you have one)* — KEITH W NASH & CO

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)* — 90-92 Regent Street
Cambridge
CB2 1DP

SWINDELL & PEARSON
48 FRIAR GATE
DERBY
DE1 1GY

Patents ADP number *(if you know it)* — 1206001

1578001 51/77

6. Priority: Complete this section if you are declaring priority from one or more earlier patent applications, filed in the last 12 months

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

7. Divisionals, etc: Complete this section only if this application is a divisional application or resulted from an entitlement dispute (see note f)

Number of earlier applications	Date of filing *(day / month / year)*

8. Is a Patents Form 7/77 (Statement of Inventorship and of right to grant of a patent) required in support of this request?
Answer YES if:
a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body:
Otherwise answer NO (See note d)

Patents Form 1/77

Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form	
Description	6
Claims(s)	CF
Abstract	
Drawing(s)	1 + (

10. If you are also filing any of the following, state how many against each item.

Priority documents	
Translations of priority documents	
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
Request for preliminary examination and search *(Patents Form 9/77)*	
Request for substantive examination *(Patents Form 10/77)*	
Any other documents *(please specify)*	

11. I/We request the grant of a patent on the basis of this application.

Signature(s) Keith W Nash & Co Date

12. Name, daytime telephone number and e-mail address, if any, of person to contact in the United Kingdom — David L Roberts — 01223 355477

Warning

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Notes

a) *If you need help to fill in this form or you have any questions, please contact the Patent Office on 08459 500505.*

b) *Write your answers in capital letters using black ink or you may type them.*

c) *If there is not enough space for all the relevant details on any part of this form, please continue on a separate sheet of paper and write "see continuation sheet" in the relevant part(s). Any continuation sheet should be attached to this form.*

d) *If you have answered 'Yes' Patents Form 7/77 will need to be filed.*

e) *Once you have filled in the form you must remember to sign and date it.*

f) *Part 7 should only be completed when a divisional application is being made under Section 15(4), or when an application is being made under section 8(3), 12(6) or 37(4) following an entitlement dispute. By completing part 7 you are requesting that this application takes the same filing date as an earlier UK application. If you want the new application to have the same priority date(s) as the earlier UK application, you should also complete part 6 with the priority details.*

C1368.00/C

Saw Blades

Field of the Invention

This invention relates to saw blades, to methods of making saw blades and to teeth for such blades.

Background to the Invention

The applicants' published PCT Specification WO 01/83143 discloses methods of making saw blades by forcing tungsten carbide inserts into apertures in a comparatively soft carrier strip. Building on this technology, the present application is directed to developments which offer the opportunity of cost savings in manufacture of saw blades and greater versatility in the choice of the characteristics of the teeth of saw blades.

Summary of the Invention

According to a first aspect of the invention there is provided a plurality of hard teeth for attaching to a relatively soft common carrier of a saw blade, the teeth being of differing shapes and/or having different material compositions so that the resulting saw blade has teeth with different characteristics.

This aspect of the invention also provides a saw blade comprising a relatively soft carrier supporting a plurality of relatively hard teeth, wherein the teeth are of differing shapes and/or have different material compositions. The pitch of the teeth along the carrier may be constant or may vary. The carrier may be a carrier strip of a linear edge saw blade, the latter term including within its scope a rectilinear or curved blade.

A known linear edge saw blade is made by mounting identical inserts at spaced positions along a carrier strip, securing the inserts to the strip by brazing and then grinding the edges of the inserts and carrier strip to form a series of identically shaped teeth along the length of the blade. By pre-forming the inventive teeth in different shapes corresponding to the required final shape of the teeth, the grinding operations normally required to finish carbide tipped teeth are minimised or avoided, resulting in a significant cost saving. Moreover, different teeth along the length of a linear edge saw blade perform differing cutting functions dependent on their position in the cutting sequence. For example, leading teeth wear differently from trailing teeth. By recourse to the invention, individual teeth can be pre-formed to a required shape, and made of a composition as desired, without the need for substantial grinding. Thus, the characteristics of individual teeth can vary along the length of the carrier strip. In the preferred embodiment to be described, the teeth are in successive groups, with each group consisting of three teeth of different shapes, giving a successive triple cut configuration.

The invention also includes within its scope a method of making a saw blade, the method comprising fabricating a plurality of relatively hard teeth having differing shapes corresponding to the desired final shapes of the teeth of the blade, mounting the teeth at desired spaced mounting positions on a carrier of a relatively soft material and securing the teeth in their positions by brazing.

The mounting of the teeth in the carrier preferably causes deformation and displacement of the material of the carrier, and this may be achieved by forcing the teeth into apertures in the carrier. The teeth may have teeth roots with peripheries which form cutting edges to displace the material of the carrier as the inserts are forced into position.

The invention is also applicable to circular saws, in which case the carrier is in the shape of a disc around the outer periphery on which the teeth are supported.

According a yet further aspect of the invention there is provided a tooth for a saw blade, the tooth having a root for attachment to a carrier of the blade and a head forming a cutting

portion of the tooth when the latter is advanced in the cutting direction, the root and head being separated by a transition region which, when the tooth is viewed in side view transverse to the cutting direction, is in the shape of a neck as a consequence of having a width less than the maximum width of the root and less than the maximum width of the head.

The root may have a periphery which is curvilinear in side view, the curvilinear edge being sufficiently sharp to enable the insert to be forced into the carrier from one side thereof, optionally being forced into a pre-formed pilot slot or hole in the carrier with attendant displacement and deformation of the material of the carrier, prior to the tooth being secured in position by brazing. Each tooth may cut its own aperture, a pre-formed slot or hole in the carrier not then being necessary.

The invention includes within its scope a saw blade comprising a carrier supporting a plurality of teeth each in accordance with the yet further aspect of the invention. Also included within the invention is a method of making a saw blade, the method comprising mounting teeth, each in accordance with the yet further aspect of the invention, on a comparatively soft carrier.

In its further aspect, the invention is applicable to linear edge saw blades and to circular saw blades. In the former case, the carrier is in the form of an elongate carrier strip and in the latter case the carrier is disc-shaped.

Brief Description of the Drawings

The invention will now be further described, by way of example, with reference to the accompanying drawings, in which:

Figures 1 to 3 are perspective views of three individual teeth according to the invention;

Figure 4 is a composite view illustrating in end view the three teeth of Figures 1 to 3;

Figure 5 is a perspective view of a first form of carrier strip showing teeth being mounted therein;

Figure 6 is a side elevation of the carrier strip of Figure 5,

Figure 7 is a perspective view showing the three teeth of Figures 1 to 3 mounted in the carrier strip of Figure 5; and

Figure 8 is a side elevation corresponding to Figure 6, but showing an alternative shape of carrier strip.

Detailed Description of the Drawings

Referring to Figures 1 to 3, each tooth is moulded from tungsten carbide material in the shape illustrated, the tooth having a head 1 and a root 2 with a transition region 3 therebetween. Each head 1 has a planar front face 4, planar sides 5 and a planar rear face 6. As can be seen from Figure 4, the planar sides 5 are non parallel, converging slightly in a direction towards the root 2 of the tooth. Each root 2 has planar parallel side faces 7 which join a convex curved wall 8 along curved edges, giving the root 2 a part-circular shape in side view. On one side of the tooth, the curved edge acts as a cutting edge when the tooth is mounted on the edge of the carrier strip.

At the transition region 3, the convex wall 8 merges smoothly into a concave wall at the front of the tooth and into a concave wall at the rear of the tooth, these two concave walls merging into respective shoulders where they are adjoin the head of the tooth. As a result, when each tooth is viewed from the side the transition region 3 forms a neck which has a narrower width than the maximum width of the head 1 and a narrower width than the maximum width of the root 2.

The teeth of Figures 1 to 3 differ in the shapes of the upper portions of their heads. The tooth of Figure 1 has a comparatively large chamfer 9 formed (by moulding of the tooth) along each top edge, the tooth of Figure 3 has a comparatively small chamfer 9 formed along each top edge and the tooth of Figure 2 has an intermediate size of chamfer 9. As a consequence, the front cutting faces 4 of the teeth present different shapes and different cutting areas. The teeth of Figures 1 to 3 may also differ in composition.

The three teeth of Figures 1 to 3 form a group of three teeth which are mounted in the carrier strip 10 (Figures 5 and 6) which is made from a flexible steel strip which is comparatively soft in relation to the hard material of the teeth. The carrier strip 10 is punched to have the profile shown in Figure 6, there being at regularly spaced positions a series of apertures each in the form of an arcuate slot 12 open to the edge of the carrier strip 10. Between adjacent slots 12 the carrier strip edge has an inclined portion 13 merging into a vertical portion 14.

The root 2 of each tooth is oversize in relation to the slot 12 and each root is forced into a corresponding slot 12, as indicated by the arrow in Figure 5, with attendant displacement and deformation of the material of the carrier strip 10. When the teeth have been located in the carrier strip edge in this manner, the teeth are anchored in the carrier strip by brazing. The shape of the neck and the provision of shoulders between the neck and the head contribute to a firm attachment of each tooth in the strip 10. As best seen from Figure 6, the front face 4 of each tooth forms a smooth continuation with the corresponding vertical wall portion 14 and the inclined wall portion 13 forms a smooth continuation of the chamfered top edge of each tooth. By pre-forming the shapes of the teeth, there is no need for a grinding operation to be carried out, although a small degree of finish grinding may be carried out.

Figure 7 shows the group of three teeth mounted in the carrier strip 10 and also the first tooth of the next group. Thus, the resulting linear edge saw blade has successive groups of teeth, with each group consisting of the three teeth shown in Figures 1 to 3. The cutting direction is towards the left as the blade is viewed in Figure 7.

Figure 8 shows a modified shape of carrier strip 15 where each aperture is in the form of a hole 16 punched through the strip near the edge of the latter, instead of being a slot open to the edge of the strip. Each tooth is punched into a corresponding hole 16, the result being as shown at the left hand end of Figure 8.

Figures 5 to 8 show carrier strips 10 and 15 where the teeth are forced into pre-formed apertures from the side of the carrier strip. Instead, the teeth may be forced downwardly, into slots in a carrier strip, relying on the elasticity of the latter to receive and then retain the teeth prior to brazing.

Figures 5 and 7 show the teeth being mounted on a carrier strip of a linear edge saw blade. When the invention is applied to a circular saw blade, a disc-like carrier has an outer periphery around which the groups of teeth (corresponding to the teeth of Figures 1 and 4) are mounted, preferably by being forced into the edge of the softer carrier in a manner similar to that described for the linear edge saw blade. Thus, each tooth has a root with a cutting edge enabling the tooth to be forced into the edge of the carrier with attendant displacement and deformation of the material of the carrier. This locates the tooth in the carrier prior to brazing.

Thus, for both the linear edge and circular saw blades, the waisted teeth punch their own keyways in the carrier to locate the teeth in the carrier, after which the teeth are anchored in position by brazing.

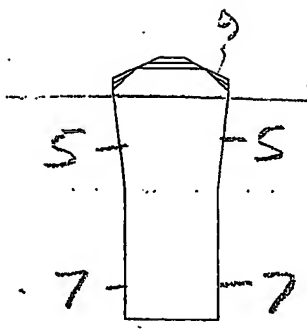

Fig 4

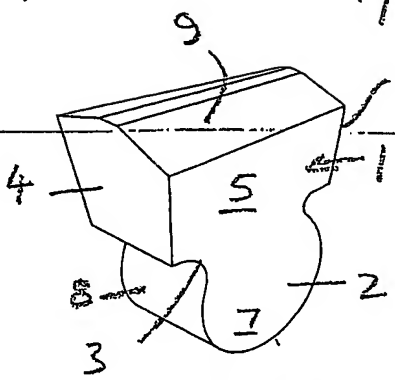

Fig. 1

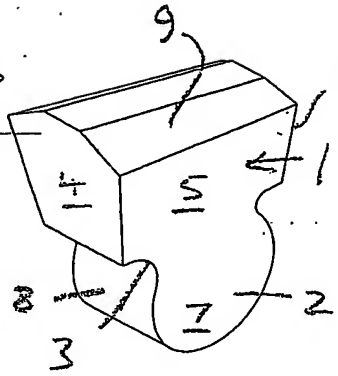

Fig. 2

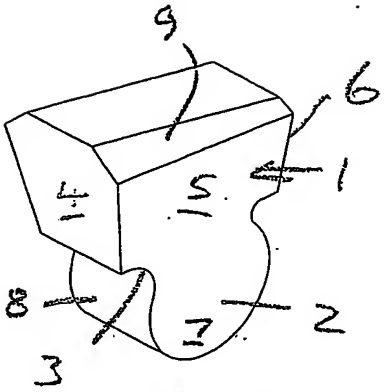

Fig. 3

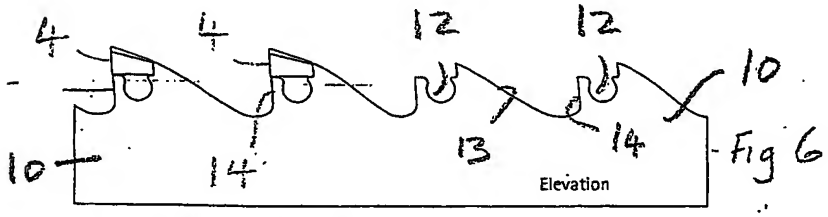

Fig 6

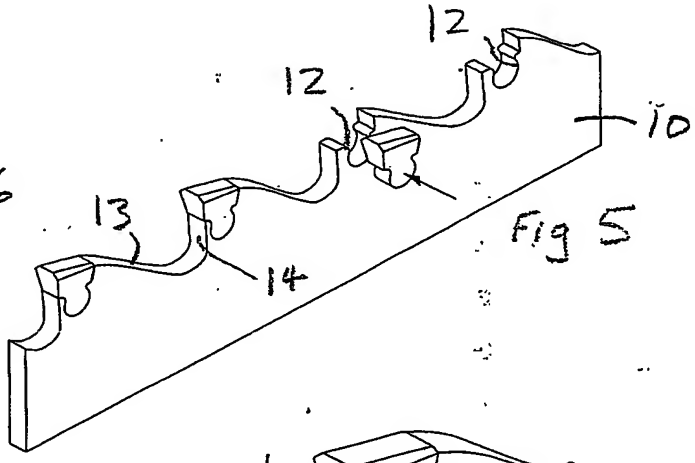

Fig 5

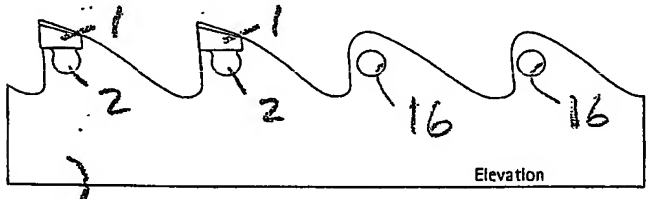

Fig. 8

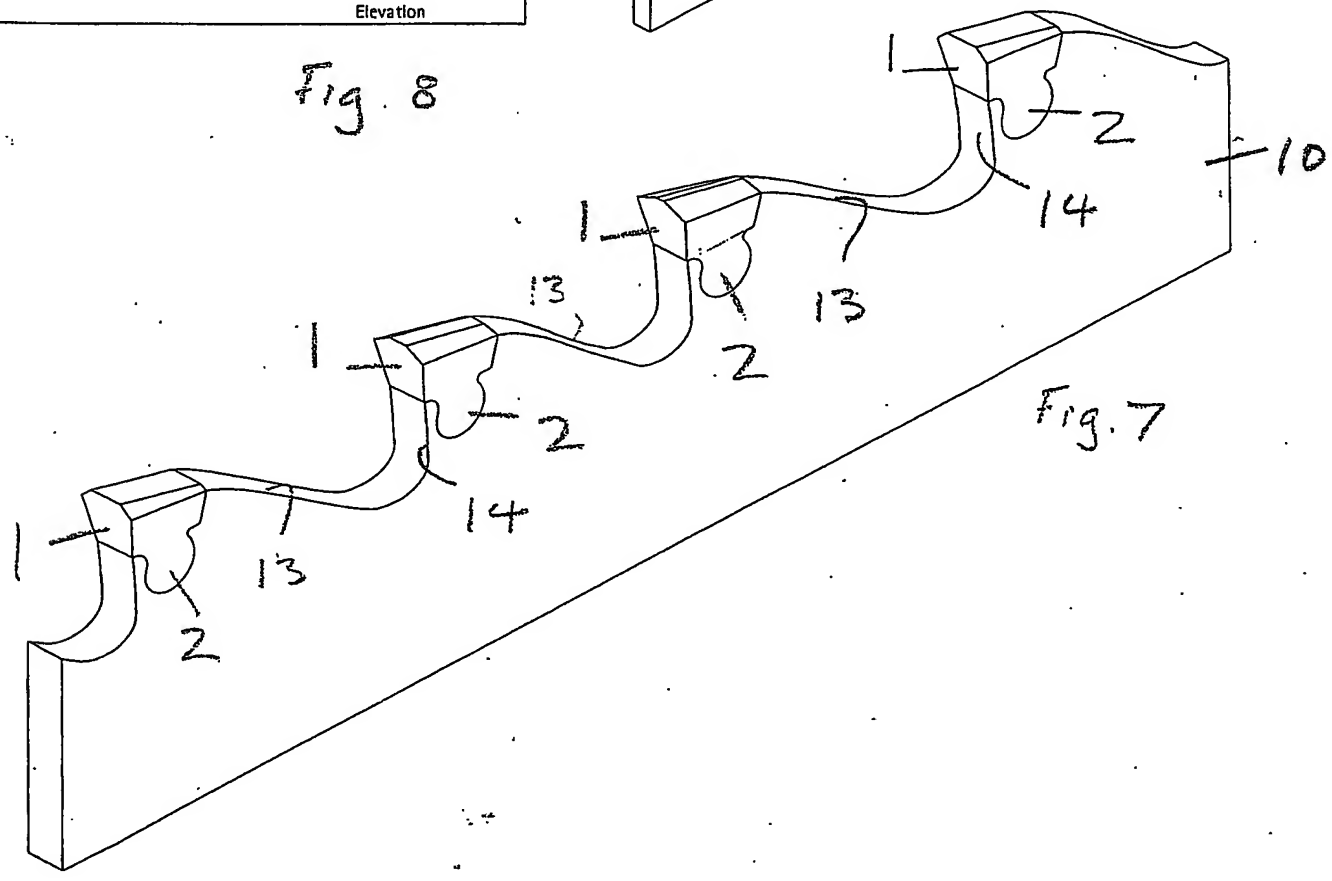

Fig. 7